

CLAIMS

1. A process for producing single crystals of a gallium-containing nitride on a seed crystal substrate by a reaction between molten gallium retained in a container inside a crystal growth chamber and nitrogen gas, the process comprising:

preparing a eutectic alloy melt of gallium (Ga);
dipping the seed crystal substrate into the eutectic alloy melt, the seed crystal substrate having a catalytic metal having a mesh, stripe, or open polka-dot pattern deposited thereon; and graphoepitaxially growing a single crystal phase of the gallium-containing nitride on the surface of the seed crystal substrate by the reaction at the surface of the seed crystal substrate between gallium, which is a component of a eutectic alloy, and nitrogen dissolving into the eutectic alloy melt from a space zone containing a nitrogen supply source above a surface of the melt.

2. The process for producing the single crystals of the gallium-containing nitride according to claim 1, wherein the catalytic metal is platinum (Pt) and/or iridium (Ir).

3. The process for producing the single crystals of the gallium-containing nitride according to claim 1, wherein at least one metal selected from the group consisting of aluminum (Al), indium (In), ruthenium (Ru), rhodium (Rh), palladium (Pd), rhenium (Re), osmium (Os), bismuth (Bi), and

gold (Au) forms the eutectic alloy melt with gallium (Ga).

4. The process for producing the single crystals of the gallium-containing nitride according to claim 1, wherein the pressure in the space zone containing the nitrogen supply source is 0.1 to 0.15 MPa.

5. The process for producing the single crystals of the gallium-containing nitride according to claim 1, wherein the nitrogen supply source is nitrogen, NH_4 , or nitrogen-containing compound gas.

6. The process for producing the single crystals of the gallium-containing nitride according to claim 1, wherein the seed crystal substrate is sapphire single crystals.

7. The process for producing the single crystals of the gallium-containing nitride according to claim 1, wherein the seed crystal substrate has a crystal layer composed of a nitride including at least gallium (Ga), aluminum (Al), or indium (In).

8. The process for producing the single crystals of the gallium-containing nitride according to claim 1, wherein a single crystal thin film of a gallium-containing nitride represented by $\text{Al}_x\text{Ga}_{1-x-y}\text{In}_y\text{N}$ ($0 < x < 1$, $0 < y < 1$, $0 < x + y < 1$) is grown from the eutectic alloy melt of gallium or by further dissolving aluminum (Al) and indium (In) in Ga.

9. The process for producing the single crystals of the gallium-containing nitride according to claim 1, wherein the

seed crystal substrate is attached to a lower end portion of a rotating/vertical drive shaft and crystals are grown while rotating the seed crystal substrate.

10. The process for producing the single crystals of the gallium-containing nitride according to claim 1, wherein the crystal growth chamber is of a vertical type in which at least two temperature zones with different temperatures in the vertical direction of the chamber are formed, and the seed crystal substrate is pulled up by the vertical drive shaft to position the seed crystal substrate in a low-temperature zone to allow crystals to grow.